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# YUKON RIVER BASIN COMMITTEE

BRITISH COLUMBIA

J. O. RIORDAN

CANADA

E. M. CLARK (Chairman)  
D. M. WATSON

YUKON

G. LIVINGSTON

## 34th ALASKA SCIENCE CONFERENCE

### YUKON RIVER BASIN STUDY

by W.G. Whitley

projector  
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THE YUKON RIVER BASIN STUDY WAS UNDERTAKEN BY THE GOVERNMENTS OF CANADA, BRITISH COLUMBIA AND YUKON TO PREPARE A FRAMEWORK PLAN FOR THE WATER AND RELATED RESOURCES OF THE BASIN. THE STUDY IS NOW IN THE THIRD AND FINAL YEAR. MOST OF THE STUDY PROJECTS ARE NEAR COMPLETION AND FIVE PROJECTS WILL BE DISCUSSED THIS MORNING. ANOTHER PROJECT IS BEING PRESENTED AT THE POSTER SESSION.

I HAVE DIVIDED MY PRESENTATION INTO TWO PARTS. THE FIRST IS A QUICK TRIP DOWN THE YUKON RIVER. I WILL DESCRIBE A FEW FEATURES AND GIVE YOU A RIVER LEVEL VIEW OF THE BASIN. THE SECOND IS A DESCRIPTION OF THE BASIN STUDY; I WILL EMPHASIZE THE WORK WE HAVE UNDERTAKEN. ADDITIONAL INFORMATION IS CONTAINED IN THE SECOND ANNUAL REPORT OF THE YUKON RIVER BASIN COMMITTEE. <sup>TO BE RELEASED IN THE NEXT TWO WEEKS.</sup> IF YOU WOULD LIKE A COPY, PLEASE SEE ME DURING THE SESSION.

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## INTRODUCTION

THE YUKON RIVER IS ABOUT 2,900 KILOMETERS LONG, DRAINING APPROXIMATELY 800,000 SQUARE KILOMETERS OF NORTHWEST NORTH AMERICA. IT IS THE FIFTH LARGEST RIVER BASIN IN NORTH AMERICA.

THE CANADIAN PORTION OF THE BASIN, WHICH IS THE SUBJECT OF THE STUDY, IS THE DRAINAGE BASIN UPSTREAM OF THE YUKON-ALASKA BORDER (141° WEST) NEAR EAGLE, ALASKA. IT HAS AN AREA OF 262,626 SQUARE KILOMETERS IN THE SOUTHERN YUKON AND NORTHWESTERN BRITISH COLUMBIA.

THE WESTERN BOUNDARY OF THE BASIN FOLLOWS THE ST. ELIAS AND COAST MOUNTAINS. THE EASTERN BOUNDARY IS THE SELWYN MOUNTAINS AND THE OGILVIE MOUNTAINS FORM THE NORTHERN BOUNDARY. THE MAJORITY OF THE BASIN IS A DISSECTED PLATEAU - THE YUKON PLATEAU.

THE CLIMATE OF THE BASIN IS DESCRIBED AS SUBARCTIC CONTINENTAL. IT MEETS THE CONTINENTAL CRITERIA OF WIDE ANNUAL, DAILY, AND DAY TO DAY RANGES OF TEMPERATURE, LOW RELATIVE HUMIDITY AND BY MODERATE OR SMALL AND IRREGULAR PRECIPITATION. THE CLASSIFICATION OF SUBARCTIC IS USED TO RECOGNIZE THAT ALTHOUGH THE CLIMATE IS RELATIVELY COLD AND DRY, STORM TRACKS AND THE PROXIMITY OF THE PACIFIC OCEAN RESULT IN FREQUENT INTRUSIONS OF MILD AIR INTO THE BASIN. TEMPERATURES RANGE FROM 36.1 TO MINUS 62.3 DEGREES CELSIUS. PRECIPITATION IS LIGHT, AVERAGING ONLY 400 MM PER YEAR AND EVEN LESS IN MOST OF THE VALLEY FLOORS.

THE BASIN CAN BE DIVIDED INTO FIVE SUB-BASINS:

STEWART RIVER

PELLY RIVER

TESLIN RIVER

WHITE RIVER

YUKON RIVER MAINSTEM - THIS SUB-BASIN CAN BE FURTHER DIVIDED INTO THE LAKE DOMINATED PORTION ABOVE THE TESLIN RIVER AND THE RIVER DOMINATED PORTION BELOW THE TESLIN RIVER.





## SECTION 1 A TRIP DOWN THE YUKON RIVER

WE ARE NOW READY FOR OUR TRIP DOWNRIVER.

THE YUKON RIVER FORMS IN THE MELTING ICE OF THE LEWELLYN GLACIER WHICH FLOWS INTO ATLIN LAKE.

THE FIRST SETTLEMENT IS ATLIN, BRITISH COLUMBIA. THE ATLIN RIVER FLOWING FROM ATLIN LAKE INTO TAGISH LAKE HAS BEEN PROPOSED FOR A WATER STORAGE DAM BY THE NORTHERN CANADA POWER COMMISSION TO FIRM FLOWS IN THE YUKON RIVER AT WHITEHORSE. TAGISH LAKE IN TURN DRAINS INTO MARSH LAKE.

THE LARGE HEADWATER LAKES ARE AN OUTSTANDING FEATURE OF THE BASIN, PROVIDING OPPORTUNITIES FOR RECREATION AND WATER STORAGE. THE OUTLETS ARE ICE FREE THROUGH MOST OF THE WINTER PROVIDING GOOD WATERFOWL SPRING STAGING SITES. THE OUTLET OF MARSH LAKE, FOR EXAMPLE, IS USED BY MANY SPECIES INCLUDING WHISTLING AND TRUMPETER SWANS.

BELOW MARSH LAKE, THE RIVER IS CROSSED BY THE ALASKA HIGHWAY AND FLOWS THROUGH THE LEWES RIVER STORAGE DAM AND MILES CANYON INTO SCHWATKA LAKE. SCHWATKA LAKE IS THE IMPOUNDMENT OF THE WHITEHORSE RAPIDS POWER PLANT. THIS PLANT PRESENTLY PROVIDES 20 MEGAWATTS OF HYDROELECTRICITY. WITH THE COMPLETION OF THE CONSTRUCTION OF THE FOURTH TURBINE NEXT YEAR IT WILL PROVIDE AN ADDITIONAL 20 MEGAWATTS FOR OVER SIX MONTHS EACH YEAR.

WHITEHORSE IS THE CAPITAL OF THE YUKON TERRITORY. IT IS THE TRANSPORTATION, COMMUNICATION AND COMMERCIAL CENTRE OF THE BASIN. MORE THAN HALF OF THE BASIN'S POPULATION OF APPROXIMATELY 23,000 LIVE HERE.

SECTION 1 A TRIP DOWN THE KAMIA RIVER

WE ARE NOW READY FOR OUR TRIP DOWNRIVER.

THE KAMIA RIVER FLOWS IN THE MELTING ICE OF THE LOWLAND BASIN  
WHICH RISES INTO MOUNTAIN.

THE FIRST SETTLEMENT IS AT LIL, BEING COLUMBIA. THE ALTA RIVER  
FLOWING FROM ALTA LAKE INTO KAMIA LAKE HAS BEEN PROVIDED FOR A WATER  
STORAGE DAM BY THE KAMIA CANADA POWER COMMISSION TO FURNISH POWER IN  
THE KAMIA RIVER AT WHITWATER. KAMIA LAKE IS THEN DRAINED INTO  
KAMIA LAKE.

THE LARGE HEADWATER LAKE AND AN OUTSTANDING FEATURE OF THE BASIN,  
PROVIDING OPPORTUNITIES FOR RECREATION AND WATER STORAGE. THE OUTLET  
ARE ICE FREE THROUGH MOST OF THE WINTER PROVIDING GOOD WATERWAY SPRING  
STAGING RIVER. THE OUTLET OF KAMIA LAKE, FOR EXAMPLE, IS USED BY MANY  
SPECIES INCLUDING WILSON'S AND THUNDER BAY.

BELOW KAMIA LAKE, THE RIVER IS CONTROLLED BY THE ALTA HIGHWAY AND FLOWS  
THROUGH THE KAMIA RIVER STORAGE DAM AND KAMIA LAKE INTO KAMIA LAKE.  
KAMIA LAKE IS THE INCOMING OF THE WHITWATER RIVER PLANT.  
THIS PLANT PRESENTLY PROVIDES NO RECREATION OR HYDROELECTRICITY. WITH  
THE COMPLETION OF THE CONSTRUCTION OF THE KAMIA THERMAL PLANT NEXT YEAR  
IT WILL PROVIDE AN ADDITIONAL 10 RECREATION FOR OVER SIX MONTHS EACH YEAR.

WHITWATER IS THE CAPITAL OF THE KAMIA TERRITORY. IT IS THE  
TRANSPORTATION, COMMUNICATION AND COMMERICAL CENTRE OF THE BASIN.  
MORE THAN HALF OF THE BASIN'S POPULATION OF APPROXIMATELY 22,000  
LIVE HERE.



5 BELOW WHITEHORSE, THE YUKON RIVER IS JOINED BY THE TAKHINI RIVER  
BEFORE FLOWING INTO LAKE LABERGE - WHICH WAS MADE FAMOUS BY ROBERT  
SERVICE IN THIS POEM "THE CREMATION OF SAM McGEE". FOR RIVER  
TRAVELLERS, THIS IS THE MOST DANGEROUS PART OF THE TRIP AS LARGE WAVES  
CAUSED BY STRONG SOUTHERN WINDS FREQUENTLY CAUSE DIFFICULTIES FOR  
SMALL BOATS.

6A THE RIVER FLOWS BETWEEN HIGH BANKS FOR THIRTY MILES TO ITS JUNCTION WITH  
THE TESLIN RIVER AT HOOTALINQUA. THIS SECTION IS THE LAST WHERE CLEAR  
WATER WILL BE FOUND ON OUR TRIP. HIGH SILT BANKS UNDERCUT BY THE RIVER  
GRADUALLY CREATE A SUBSTANTIAL SILT LOAD IN SUMMER. FISH CAMPS  
7 ARE COMMON ALONG THE RIVER WHERE SALMON ARE NETTED AND DRIED.

8 A MAJOR POTENTIAL HYDROELECTRIC POWER SITE IS LOCATED AT EAGLES NEST  
BLUFF UPSTREAM OF CARMACKS. THIS PROJECT NAMED "THE MID-YUKON PROJECT"  
COULD BE DEVELOPED TO PRODUCE AS MUCH AS 480 MEGAWATTS.

19 CARMACKS IS LOCATED AT THE MOUTH OF THE NORDENSKIOLD RIVER WHERE THE  
KLONDIKE HIGHWAY CROSSES THE YUKON RIVER. DOWNSTREAM OF CARMACKS  
20, 21 IS THE FIVE FINGER RAPIDS.

23, 24 FORT SELKIRK IS AN ABANDONED TOWN WHICH IS BEING RESTORED AT THE JUNCTION  
25 OF THE YUKON RIVER AND THE PELLY WHICH RISES IN THE SELWYN MOUNTAINS.

26 ROBERT CAMPBELL EXPLORED THIS AREA FOR THE HUDSON BAY COMPANY BETWEEN  
1843 AND 1852.

28 THE YUKON TURNS TO THE EAST TO MEET THE WHITE RIVER. THE WHITE RIVER  
CARRIES LARGE AMOUNTS OF SEDIMENTS INTO THE YUKON FROM THE GLACIERS  
OF THE ST. ELIAS MOUNTAINS.

BELOW MONTICLOSA, THE TUNJO RIVER IS JOINED BY THE TAMBIKI RIVER  
WHICH FLOWS INTO LAKE LAUREL - WHICH WAS BUILT UP BY  
DAMMING IN THE FORM "THE CEMENTION OF THE TUNJO" - THE RIVER  
TRAVELERS, THIS IS THE MOST DANGEROUS PART OF THE RIVER AS LAKE LAUREL  
CAUSED BY STANDING SOFTENED WINDS FREQUENTLY CAUSE SITUATIONS FOR  
SMALL BOATS.

THE FIRST PLANT GROWN HERE TAKES THE FORM OF THE TUNJO WITH  
THE TUNJO RIVER AT MONTICLOSA. THIS SECTION IS THE LAST WHERE  
WATER WILL BE FOUND ON THE TUNJO. WITH RIVER DAMS THROUGHOUT AT THE RIVER  
CHANGING CREATE A SUBSTANTIAL BUILT UP IN LAUREL. THE CAMP  
AND GROUND ALONG THE RIVER WERE CALLED THE TUNJO AND LAUREL.

A MAJOR POTENTIAL HYDROELECTRIC POWER SITE IS LOCATED AT LAUREL NEXT  
TO THE TUNJO RIVER. THIS TUNJO RIVER "THE MID-RIVER POWER"  
COULD BE DEVELOPED TO PRODUCE AS MUCH AS 400 MEGAWATTS.

CANAL IS LOCATED AT THE MOUTH OF THE TUNJO RIVER WHERE THE  
KIDNAPING RIVER CARRIES THE TUNJO RIVER. LOCATIONS OF CANALS  
IN THE FIVE FINGER MOUNTAINS.

FORT SERRA IS AN ABANDONED TOWN WHICH IS BEING REBUILT AT THE JUNCTION  
OF THE TUNJO RIVER AND THE TUNJO RIVER IN THE FIVE FINGER MOUNTAINS.

ROBERT CARROLL EXPLORED THIS AREA FOR THE TUNJO RIVER BETWEEN  
1943 AND 1952.

THE TUNJO RIVER TO THE EAST TO THE WHITE RIVER. THE WHITE RIVER  
CARRIES LARGE AMOUNTS OF SEDIMENT INTO THE TUNJO RIVER AND FLUENTS  
ON THE ATLAS MOUNTAINS.



THE STEWART RIVER JOINS THE YUKON RIVER FROM THE EAST ABOUT TWENTY KILOMETERS FURTHER DOWNRIVER. IT IS THE LAST LARGE TRIBUTARY RIVER ENTERING THE BASIN IN CANADA. AT THE MOUTH OF THE STEWART IS STEWART ISLAND. THIS ISLAND HAS BEEN A POLICE POST, WOOD CAMP, ORE TRANSFER STATION FOR SILVER CONCENTRATES FROM THE MAYO DISTRICT AND, FOR MANY YEARS, THE HOME OF THE BURIAN FAMILY.

THE YUKON NOW FLOWS NORTH PICKING UP SMALLER TRIBUTARIES OF PLACER GOLD MINING FAME, THE SIXTY MILE, INDIAN AND KLONDIKE RIVERS. DAWSON IS THE LAST SETTLEMENT ON THE YUKON RIVER. BUILT JUST DOWNSTREAM OF THE MOUTH OF THE KLONDIKE RIVER, DAWSON IS PRONE TO ICE JAM FLOODING FROM THE YUKON AND KLONDIKE RIVERS. BELOW DAWSON, THE RIVER TURNS NORTHEAST TOWARDS THE ALASKA BORDER.

THE YUKON RIVER BASIN'S MAJOR INDUSTRIES ARE MINING AND TOURISM. THE BASIN HAS THE DISADVANTAGE OF BEING FAR FROM THE MARKETS FOR ITS MINERAL PRODUCTS. HOWEVER, IT IS ASTRIDE THE LAND ACCESS ROUTES TO ALASKA AND THE BEAUFORT SEA. THE BASIN HAS ADEQUATE HYDROELECTRIC RESOURCES TO ASSIST DEVELOPMENT.

projector

POTENTIAL DEVELOPMENT ALTERNATIVES IN THE BASIN MAY BE EVALUATED. WE WILL ACHIEVE THIS OBJECTIVE BY COMPLETING STUDIES WHICH WILL FILL IN THE WATER AND RELATED RESOURCE INFORMATION BASE AND THEN FORMULATING GUIDELINES FOR THE DEVELOPMENT OF THESE RESOURCES.

THERE ARE EIGHT STUDY AREAS - HYDROLOGY, WATER QUALITY, WILDLIFE, TOURISM, FISH AND RECREATION, FURNURES, SOCIO-ECONOMIC, ENERGY AND PLACER MINING. FOR EACH STUDY AREA, A WORK GROUP CONSISTING OF EXPERTS, PRIMARILY FROM GOVERNMENT, WAS FORMED. EACH WORK GROUP IS RESPONSIBLE FOR RECOMMENDING A STUDY PROGRAM AND FOR DRAWING CONCLUSIONS FROM THE RESULTING RESOURCE DATA BASE. THE WORK IS COORDINATED BY A STUDY OFFICE.





## SECTION 2 THE BASIN STUDY

35 THE CANADA WATER ACT PROVIDES FOR JOINT RIVER BASIN STUDIES BY THE  
FEDERAL AND PROVINCIAL GOVERNMENTS. WATER RESOURCES ARE A PROVINCIAL  
RESPONSIBILITY WITH THE FEDERAL GOVERNMENT RESPONSIBLE FOR THE WATER  
RESOURCES OF THE YUKON TERRITORY AS WELL AS INTERJURISDICTIONAL WATERS.  
THE YUKON RIVER BASIN STUDY IS THE MOST RECENT STUDY UNDER THE ACT.

IN NOVEMBER 1980 "AN AGREEMENT RESPECTING STUDIES AND PLANNING OF THE  
WATER RESOURCES IN THE YUKON RIVER BASIN" WAS SIGNED BY CANADA,  
BRITISH COLUMBIA, AND THE YUKON. IT IS CURRENTLY UNTIL DECEMBER 30,  
1983 ALTHOUGH WE EXPECT IT TO BE EXTENDED UNTIL SEPTEMBER 1984 TO ALLOW  
FOR THE COMPLETION OF THE FINAL REPORT. FUNDING IS LIMITED TO A  
MAXIMUM OF 2.2 MILLION DOLLARS.

36 THE AGREEMENT RECOGNIZES THAT CONFLICT IS POSSIBLE BETWEEN THE  
DEVELOPMENTS IN ENERGY, MINING, TRANSPORTATION, AND RECREATION.  
THE OBJECTIVE OF THE AGREEMENT IS TO UNDERTAKE JOINTLY STUDIES  
LEADING TO THE FORMULATION OF A PLANNING FRAMEWORK UNDER WHICH  
37 POTENTIAL DEVELOPMENT ALTERNATIVES IN THE BASIN MAY BE EVALUATED.  
WE WILL ACHIEVE THIS OBJECTIVE BY COMPLETING STUDIES WHICH WILL FILL  
IN THE WATER AND RELATED RESOURCE INFORMATION BASE AND THEN FORMULATING  
GUIDELINES FOR THE DEVELOPMENT OF THESE RESOURCES.

38 THERE ARE EIGHT STUDY AREAS - HYDROLOGY, WATER QUALITY, WILDLIFE,  
TOURISM, PARKS AND RECREATION, FISHERIES, SOCIO-ECONOMIC, ENERGY AND  
PLACER MINING. FOR EACH STUDY AREA, A WORK GROUP CONSISTING OF  
EXPERTS, PRIMARILY FROM GOVERNMENT, WAS FORMED. EACH WORK GROUP IS  
RESPONSIBLE FOR RECOMMENDING A STUDY PROGRAM AND FOR DRAWING CONCLUSIONS  
FROM THE RESULTING RESOURCE DATA BASE. THE WORK IS COORDINATED BY  
A STUDY OFFICE.





I WOULD LIKE TO SPEND THE LAST FEW MINUTES INTRODUCING YOU TO THE MANY STUDIES THAT WE HAVE UNDERTAKEN.

#### HYDROLOGY

- STUDY OF THE WINTER ICE COVER FORMATION AND BREAK-UP ON THE MAINSTEM YUKON
- DEVELOPMENT OF A COMPUTER BASED DAILY FLOW MODEL TO EVALUATE POTENTIAL HYDROELECTRIC PROJECTS
- STUDY OF NATURAL FLOODING IN THE BASIN
- REVIEW OF THE HYDROMETRIC DATA NETWORKS

#### WATER QUALITY

- OPERATION OF A ONE YEAR WATER QUALITY NETWORK TO DESCRIBE WATER QUALITY OF THE BASIN. A POSTER DISPLAY HAS BEEN PREPARED TO DESCRIBE THE PROJECT AND IS ON VIEW AT THE CONFERENCE POSTER SESSION.
- A SURVEY OF WINTER DISSOLVED OXYGEN IN TWO RIVERS HAS BEEN COMPLETED. PAUL WHITFIELD WILL BE PRESENTING HIS WORK THIS MORNING.

#### FISHERIES

- AN INVENTORY OF THE FISHERIES DATA HAS BEEN COMPLETED.
- TWO STUDIES OF THE EFFECTS OF SEDIMENTS ON GRAYLING HAVE BEEN UNDERTAKEN. GORDON ENNIS WILL BE DISCUSSING THE RESULTS TODAY.
- TWO PROJECTS APPLYING AN ECOLOGICAL LAND SURVEY TECHNIQUE TO INVENTORY AND EVALUATE FISH HABITAT IN THE MAYO AND ATLIN PLACER MINING DISTRICTS ARE UNDERWAY.





- FOUR LAKES HAVE BEEN THE SUBJECT OF CREEL CENSUS.
- A STUDY OF THE PRODUCTIVITY OF BASIN LAKES WAS UNDERTAKEN.  
JOHN STOCKNER WILL BE DISCUSSING HIS FINDINGS THIS MORNING.

#### WILDLIFE

- TIM COLEMAN WILL BE REPORTING ON HIS WORK WITH WATERFOWL  
USING THE NISUTLIN DELTA ON TESLIN LAKE.
- BRIAN SLOUGH AND HARVEY JESSUP WILL BE PRESENTING THEIR  
WORK ON FURBEARERS THIS MORNING.
- AN INVENTORY OF MOOSE IN THE SOUTHWEST BASIN HAS BEEN UNDERTAKEN.
- A PROJECT LOOKING AT THE USE OF SPRING STAGING AREAS AND  
RIVERS BY WATERFOWL HAS BEEN UNDERTAKEN.

#### TOURISM PARKS & RECREATION

- AN INVENTORY OF INFORMATION IS BEING DEVELOPED
- A SURVEY OF THE RECREATIONAL CAPABILITY OF RIVERS AND LAKES  
IS ALMOST COMPLETE

#### PLACER MINING

- A DESCRIPTION OF PLACER MINING IN THE BASIN HAS BEEN COMPLETED.
- THREE OF THE FISHERIES PROJECTS ALSO RELATE TO PLACER MINING.

#### ENERGY

- AN ARCHIVAL SEARCH TO LOCATE DOCUMENTS ON ENERGY IN THE BASIN  
HAS BEEN UNDERTAKEN.
- AN INVENTORY OF ALL IDENTIFIED HYDROELECTRIC PROJECTS
- A STUDY OF THE POTENTIAL FOR GRID INTERCONNECTIONS WITH  
BRITISH COLUMBIA, NORTHWEST TERRITORIES AND ALASKA
- A REVIEW OF PREVIOUS ELECTRICAL DEMAND STUDIES.
- A STUDY OF HYDROELECTRIC PLANNING
- A STUDY OF THE ALTERNATIVES TO HYDROELECTRICITY IN THE BASIN.





SOCIO-ECONOMIC

- AN INPUT/OUTPUT TABLE FOR THE ECONOMY HAS BEEN DEVELOPED.
- ECONOMIC ACCOUNTS FOR THE YUKON ARE BEING DEVELOPED.
- A COMPUTER BASED MODEL OF THE ECONOMY HAS BEEN COMPLETED.
- A DESCRIPTION OF THE ECONOMY IS UNDERWAY.
- A STUDY OF THE INSTITUTIONS, LAWS AND LEGISLATION WHICH HAVE BEEN ESTABLISHED TO MANAGE THE WATER AND RELATED RESOURCES OF THE BASIN IS UNDERWAY



CONCLUSION

THE REPORT OF THE YUKON RIVER BASIN COMMITTEE WILL BE RELEASED IN THE FALL OF 1984. IT WILL MAKE RECOMMENDATIONS LEADING TO THE IMPROVEMENT OF WATER AND RELATED RESOURCE PLANNING AND MANAGEMENT IN THE BASIN. INFORMATION DEVELOPED BY THE STUDY HAS ALREADY BEEN USED IN THE YUKON PLACER MINING GUIDELINES REVIEW COMMITTEE HEARINGS AND I BELIEVE THAT THE INDIVIDUAL PROJECTS THAT WE HAVE UNDERTAKEN WILL THEMSELVES MAKE A SUBSTANTIAL CONTRIBUTION TO IMPROVED DECISION MAKING.

I AM PLEASED THAT EVEN THOUGH THE STUDY IS NOT COMPLETED THAT FIVE PROJECTS CAN BE DISCUSSED WITH YOU TODAY, PERHAPS SOME OF THE OTHERS CAN BE PRESENTED AT THE 35th CONFERENCE.



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